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NATURAL PETROLEUM GASES AND CRACKING GASES OF THE USSR AND THEIR PROCESSING METHODS

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On 21 March 1940, an open plenum of the motor fuel section of the Academy of Sciences USSR was held. More than 75 specialists from various scientific research establishments and industry, consumers of high-octane fuels, motor manufacturers, and members of other organizations participated. Two reports were heard: one by Professor V. A. Sokolov on "Natural Gases of the USSR, Their Chemical Composition and New Methods of Analysis", and the other by Corresponding Member M. A. Kapelyushnikov on "Gases as Raw Materials for the Production of High-Octane Fuels."

In his report, Sokolov pointed out that fuel gases can play a most important part in fuel economy, as is demonstrated in the case of the US. Production of natural petroleum gases in the US amounted to about 70 million tons in 1939, that is, more than twice the production of petroleum (including gases) in our country during the same year.

The speaker pointed out that in the US, the gases are utilized as fuel, for the production of carbon black and of high-octane fuels, and as raw material for chemical processes.

The principal USSR petroleum-bearing areas in which industrial gas resources have been located and the chemical composition of the gases were listed by the speaker as follows:

Composition of Natural Gases of the USSR

Area	H_2S	CO_2	CH_4	C_2H_6	C_3H_8	C_4H_{10}	C_5H_{12} and Higher	N_2 and Other	USSR Resources of Natural Gases, 1 Jun 1938 (billion cu m)
Azerbaydzhan	---	6.3	90.2	1.9	0.4	0.5	0.7	---	45
Southern Dagestan	---	7.5	88.0	1.9	0.6	0.6	---	---	45
Groznzy	---	---	52.	11.	17.	16.	4.	---	4
Maykop	---	6.	68.	8.5	7.5	10.0		---	3
Emba	---	2.6	82.5	6.3	3.3	2.2		3.1	40
Buguruslan	0.4	0.2	75.5	8.7	4.5	3.1	1.8	5.7	--
Permskoye (Prikamskoye)	---	0.2	34.0	15.	9.5	3.2	1.6	36.5	30
Ishimbayevo	3.9	1.2	47.4	15.9	18.4	3.7		5.9	0.8
Ukhta	0.1	0.2	98.	---	---	---	---	1.7	25 (100-150, according to other sources)
Turkmeniya	---	0.6	81.5	2.	6.5	4.0		---	--

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The above table illustrates the variation in chemical composition of the gases. For example, whereas in Azerbaydzhan and Dagestan, the gases consist of 90% methane, at Groznyy, Maykop, Buguruslan, and Ishimbayevo, the methane content is lower and the contents of other components increase correspondingly. Gases of the Emba and Middle Asian petroleum deposits occupy an intermediate position. Such are, in their general aspects, the characteristics of those gases which are found in the European USSR. The speaker noted that making total estimates of gas resources is a very difficult and complex task, and that such work has not yet been sufficiently developed.

In his conclusion, the speaker pointed out the necessity of organizing production of standard gas apparatus and consolidating research methods to obtain more accurate results. In addition, it is indispensable to develop widely systematic work on study of the gases and, in particular, to free gas apparatus of liquid air.

In the second report, Kapelyushnikov presented an analysis of those changes which have occurred in the field of petroleum chemistry and technology in the US during the last 6 years. The speaker also described the basic trends in the development of motor construction -- trends which have considerably increased the demand for high-octane fuels. He pointed out that whereas previously, the demand for high-octane fuels was fully met by high-grade gasolines derived from petroleum, at present, this is no longer sufficient from a quantitative as well as a qualitative standpoint. Hence, the chemistry and technology of petroleum have reached a new, higher stage of development. For the production of high-octane gasoline, there are now being utilized as raw materials the unsaturated gases obtained in thermal processes of petroleum-products conversion, as well as individual fractions of natural petroleum gases.

The speaker described the principal industrial methods of converting gases into high-octane fuels, namely: (1) processes of gas polymerization (thermal and catalytic); (2) catalytic and thermal alkylation; (3) dehydrogenation of natural petroleum gases; and (4) syntheses of a whole series of specific organic compounds having antiknock properties.

Especially stressed in the report were processes of catalytic alkylation and dehydrogenation of saturated petroleum gases. Both these processes constitute an important advance in the field of high-octane fuel production and are of the greatest importance to our national economy.

The process of catalytic alkylation is important because, omitting the hydrogenation step, it does not require utilization of hydrogen.

So far as dehydrogenation is concerned, this process permits a considerable increase in the resources of raw materials for the production of high-octane fuels. The speaker indicated that these problems have not been allocated adequate place in the plans of the work of the Academy of Sciences and that in these problems, we have fallen behind the US. Therefore, in the work of the motor fuel section of the Academy of Sciences, this problem must be allocated a predominant position.

In the debate, the following participated: Academician S. S. Nametkin; Professor A. D. Petrov; Professor Frost; V.I. Yelanskiy, head, Motor Testing Station, Institute of Mineral Fuels (IGI); M. G. Gurevich, A. Z. Veselov, L. A. Selskiy, Scientific Associates of IGI; and others. Those participating in the debate pointed out the timeliness and importance of the propounded problems and indicated the necessity of quickly introducing into our industry the results of investigations in modern methods of producing high-octane fuels.

The conference appointed a special commission under the chairmanship of Academician S. S. Nametkin for the development of means pertaining to the solution of the problem of utilization of natural petroleum gases and cracking gases.

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